VP INSTRUMENTS

VP*FlowMate* User Manual

For VP*FlowMate* probe, and VP*FlowMate* in-line (with M12 8-pole connector)

With VPStudio 1.0.19

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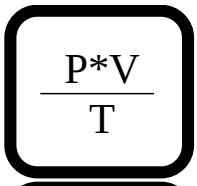
WARNING – READ THIS FIRST

Congratulations! You have bought a state of the art insertion mass flow meter from VPInstruments! The VP*FlowScope* and VP*FlowMate* are versatile and easy to use and can be very powerful tools to monitor compressed air consumption. However, there are a few important issues you need to know before using these kind of instruments. Please also see the instruction manual before use!

Insertion probes can be dangerous! Please familiarize yourself with the forces on the probe under pressurized conditions and ALWAYS use the safety chain or an additional safety belt when installing the instrument. Respect the local guidelines and regulations for working with pressurized equipment.



Gas flow through pipes follows certain physical laws. These physical laws have serious consequences for the installation requirements. Familiarize yourself with these laws to make sure that the product is installed correctly. Always make sure that upstream length, downstream length, flow, pressure, temperature and humidity ranges are within specifications.

Precision instruments need maintenance. Check your flow meter regularly and make sure it remains clean. When polluted, gently clean the sensor using demineralised water or a light cleaning solvent.

Precision instruments need regular re-calibration. The VP*FlowMate* and VP*FlowScope* are guaranteed for 24 months when used in clean, filtered, oil free and dry compressed air. When any of these conditions is not met, the re-calibration interval may become shorter than 24 months. VPInstruments offers service contracts which cover a one year re-calibration, firmware upgrades and minor repairs.

Not intended for fiscal metering or billing. The VP*FlowMate* and VP*FlowScope* are not intended for fiscal metering, as they can be shifted or turned during operation. VPInstruments recommends using in-line flow meters or a special welded fixture for these applications. Laws on fiscal metering and billing may vary per country or state.

Do not overestimate the results. The practical measurement uncertainty of an insertion probe is +/- 5%. Do not expect less than 5% measurement uncertainty from any insertion-based measurement as this is physically impossible due to the nature of turbulent pipe flows. Our products are not intended to be used as a single means to determine compressor capacity. Products are subject to improvement. VPInstruments offers software and firmware releases. Please visit www.vpinstruments.com/downloads for details.

Feedback leads to product improvement. Please share your experience with us, as we are continuously improving our products in our commitment to quality, reliability and ease of use.

Keep the above mentioned issues in mind and we are confident that you will enjoy using our products over their complete lifetime.

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1. Introduction

Thank you for choosing the VP*FlowMate* mass flow meter. The VP*FlowMate* probe and in-line are easy to use mass flow meters for compressed air. They help you to find cost savings in the shortest possible way. The VP*FlowMate* is the proven solution for mass flow measurements. The VP*FlowMate* measures mass flow and the total consumption of your compressed air.

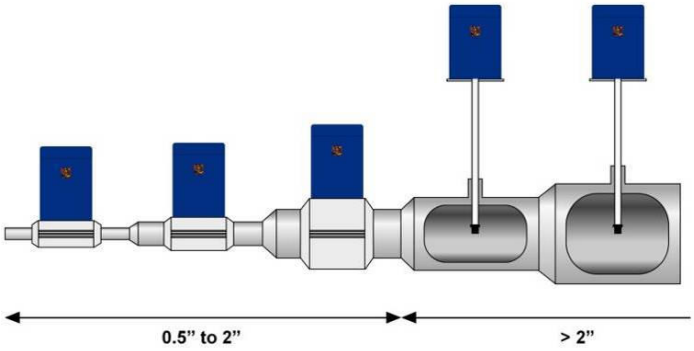
Besides compressed air, the VP*FlowMate* products can also be used in Nitrogen and technical gasses. You can use your VP*FlowMate* directly in Nitrogen. For other gasses, ask VPInstruments for their special gas calibration services.

Installation is very easy. This manual covers from mechanical installation to electrical installation to configuration and read out. We help you each step of the way so you can work easily with your flow meters.

Check the packaging box for any inconsistencies. Should there be any shipping damage, notify your local carrier. At the same time a report should be submitted to Van Putten Instruments BV, PO BOX 151, 2600 AD DELFT, The Netherlands. VPInstruments ships ExWorks.

2. Product overview

The VP*FlowMate* is available in two models: VP*FlowMate* probe and VP*FlowMate* in-line. Both are explained briefly below. This user manual covers the installation, configuration and read out of both types. For specifications on both types, go to chapter 7.



Usage: The VP*FlowMate* probe is intended for usage in pipe diameters above 2". The in-line flow meters are for usage in pipe diameters 2" and below.

VP*FlowMate* probe

The VP*FlowMate* probe is an insertion mass flow meter. The insertion probe is recommended for use for measurement in pipe diameters above 2". The VP*FlowMate* probe has the advantage that you can measure in different pipe diameters with the same device; it only needs to know the inner pipe diameter for read out in e.g. m3n/hr. Another advantage is that you can insert the flow meter in pressurized piping by using a ball valve. See chapter 3 for making installation points in pressurized conditions by hot tapping.

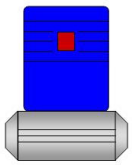
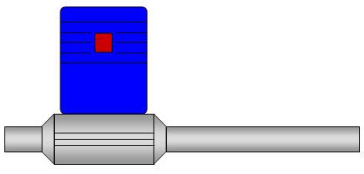
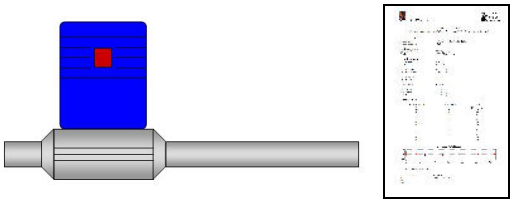
The VP*FlowMate* is available with and without display.

VP*FlowMate* in-line

The VP*FlowMate* in-line is available in three types: 0.5", 1" and 2". The VP*FlowMate* in-line has to be mounted in between the pipe. You can customize your own flow meter by choosing the options:

- In- and outlet tubes,
- ISO calibration certificate.
- Cable

The options have an influence on the accuracy of the VPFlowMate in-line:

		
VPF.RXXX.MXX.D1.Base	VPF.RXX.MXX.D1.Base + VPA.1200.0XX – Tubing kit	VPF.RXX.MXX.D1.Base + VPA.1200.0XX – Tubing kit + VPA.0009.001 ISO calibration report
5% accuracy	1% accuracy	0.5% accuracy

Display option

The VP*FlowMate* in-line features a display. The display is optional for the VP*FlowMate* probe. The display shows: mass flow on the first line and total consumption on the second line.

The VP*FlowMate* probe shows default mass flow in m_n/sec. With VPStudio you have extra option of displaying flow in m^3_n/hr. A line in the display shows which unit is selected; see pictures below.

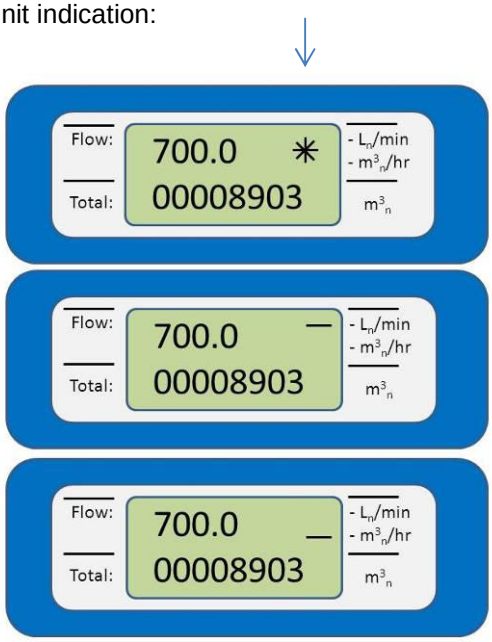
> The mass flow meters of VPInstruments measure mass flow independent from temperature and pressure; this is indicated with the "$_n$" in the units. To learn more about mass flow, please see appendix A.

The VP*FlowMate* in-line has fixed settings for displaying the mass flow. There is an extra possibility to show flow in Euro/yr, ask our sales team.

Display options:

	VP*FlowMate* probe	**VP*FlowMate* in-line**		
1. Mass flow options		0.5"	1"	2"
l_n/min		x	x	
m^3_n/hr	x			x
m_n /sec	x (default)			
2. Total consumption				
m^3_n	x	x	x	x

Unit indication:



Flow in m_n/sec: Default for VP*FlowMate* probe

Flow in l_n/min

Flow in m^3_n/hr

3. Mechanical installation

In this chapter we show you the installation of the VP*FlowMate* in your factory in the pipe line. Learn how to select the right installation point and how to install your VP*FlowMate* in the pipe.

3.1 Gasses

Your VP*FlowMate* can be used for compressed air and Nitrogen. You can also use the VP*FlowMate* for non-hazardous technical gasses; ask for our special gas calibration services.

3.2 Selecting the right installation point

First select the right installation point. In the field, additional errors are typically introduced. Sources of error can be: installation effects, unknown flow profiles, swirl, pressure effects, temperature effects, humidity effects, oscillations in the flow. The installation point is therefore crucial for an accurate measurement. To ensure the highest possible accuracy of flow measurement, the installation and piping instructions must be followed carefully. Therefore read this paragraph carefully.

Take into account:

- ONLY for dry air! Never mount the VP*FlowMate* directly in the discharge of a compressor. The high humidity and condensation will cause misreading.
- When installing the instrument, choose a site which is accessible, which allows ease of wiring and maintenance, and which allows you to still read and access the display if possible.
- Meet the specifications of the VP*FlowMate*. When the specifications are not met, for instance when the pressure or temperature level is too high, this will cause inaccurate measurement and can even damage your flow meter.

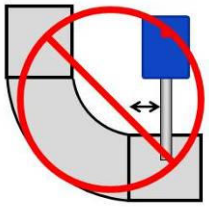
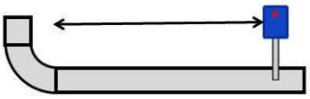
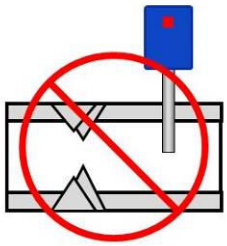
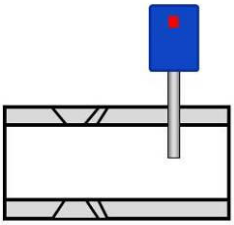
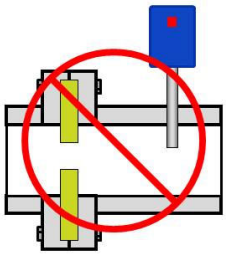
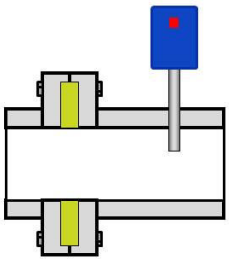
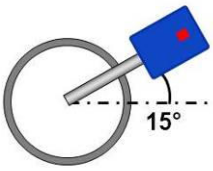
Avoid:

- Excessive heat
- Potential water damage
- Condensation
- Vibrations
- Corrosive atmosphere
- Electrical problems (high voltage/ high power)
- Mechanical vibration and danger of impact (walking bridges, fork lift trucks)
- Any source of potential error

Warning: These devices are only for use with air, nitrogen and other non hazardous, or non combustible gases. The maximum working pressure is 16 bar. Different pressure ratings are indicated on the product.

VPInstruments takes no liability for any damages or malfunctioning of the flow meter caused by pollution, dirt, water, oil or any other contamination of the medium in which you are using the flow meter. Dirt, rust particles, sand, oil droplets, or dust might damage the sensor, so make sure that all piping is clean and the air is dry and clean!

Piping guidelines

DONT'S	DO'S
	 Like any flow meter, the VP*FlowMate* requires a minimum up- and downstream piping. The immediate up- and downstream piping must be of sufficient length, straight and free of obstructions. Check de piping table on the next page for details!
	 Weld beads on the internal wall of the pipe before or after the VP*FlowMate*, should be ground flush with the pipe wall before the meter is installed.
	 Proper style and proper size gaskets should always be used when installing the VP*FlowMate*.
	 It is advised to install the VP*FlowMate* probe of least at an angle of 15° upwards. This is important to prevent the built-up of water in or around the sensor, or the connection tee. Water will have effect on the measuring results.

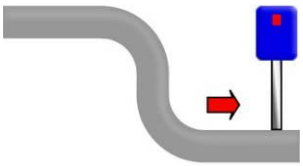
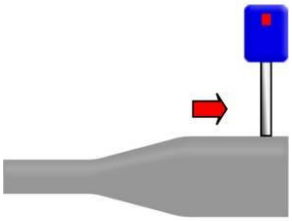
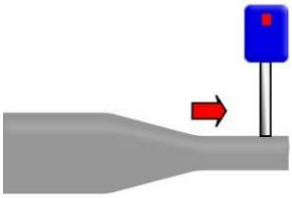
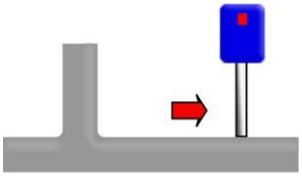
If possible, you can always choose a longer upstream length, as these are minimum values. The up- and downstream lengths are used industry wide as guidelines, and will never be a guarantee for obtaining the "true value". So always be careful and try to build up your own experience from practical measurements.

See also to the ISO 14511:2001 ("Measurement of fluid flow in closed conduits- Thermal mass flow meters") international standard.

Piping table

General rule: The VP*FlowMate* should be installed with at least 20 times the pipe diameter upstream and at least 5 times the pipe diameter downstream, to avoid any distortion of the flow profile.

For some exceptions the upstream length needs to be longer, or can be shorter. Check the piping table below for your application.

Upstream object	Description	Minimal length
	*Double elbow* These objects cause swirl and unequal flow profiles.	40 *D
	*Diameter change* (small>>big) Diameter changes can be abrupt or sloped. These changes may cause jet shaped flow profiles, which result in a high reading.	40*D
	*Diameter change* (big >> small) These objects have a positive effect. They flatten the flow profile.	10 *D
	*Closed or open branch.* These objects generate vortices and flow profile disturbance.	30*D

Communication with end-user
Sometimes you cannot meet all the installation guidelines and you have to install in non-perfect conditions. In some cases: a measurement with higher uncertainty is better than no measurement at all. Communicate this with your end-user, so they can take this uncertainty into account.

3.3 Installation of the VPFlowMate probe

Prepare the installation

The VP*FlowMate* probe can be inserted through a welding tap with internal 1/2 inch thread (see picture) or through a hot tap saddle (see below). We recommend using a 15..18 mm bore. The probe of the VP*FlowMate* has a diameter of 12.7mm.

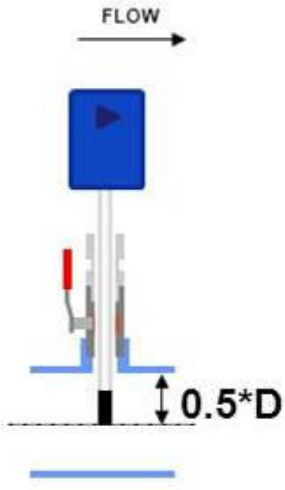
If possible, place a 1/2 inch full-bore ball valve or a 3/4 inch ball valve, so that the VP*FlowMate* insertion probe can be inserted and retracted under pressurized conditions.

Installation under pressure

By using hot tap saddles and a hot tap drill, installation points can be made in pressurized piping, without any disruption of production. VPInstruments supplies also these tools.

The installation

The VP*FlowMate* has to be installed into the pipe line through a ball valve. The bottom of the sensor must be in the middle of the pipe (see picture on the right). Note that in small tubes, wrong insertion depth can result in large measurement errors, because of the blockage effect. The arrow on the VP*FlowMate* shows the flow direction. Alignment “by the eye” is sufficient.



Determining the inner pipe diameter

The inner diameter can be calculated by subtracting two times the wall thickness of the outer pipe diameter. The pipe diameter is obtained by measuring the perimeter of the tube and dividing this by Pi (3.14…). An ultrasonic thickness gauge can be used for exact measurement of the wall thickness. VPInstruments can supply an ultrasonic thickness gauge. In a de-pressurized pipe, the internal diameter can be measured using a calliper gauge.

Follow the next steps for installation of the VP*FlowMate* insertion probe in the pipeline.

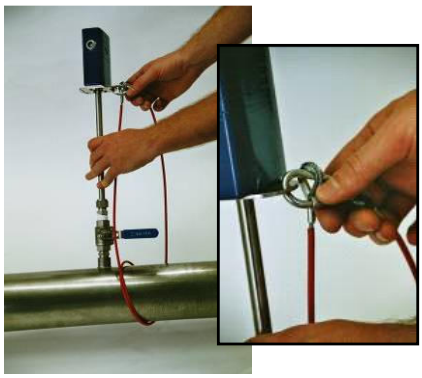
SAFETY FIRST: START WITH MOUNTING THE SAFETY LINE!
Insertion sensors can become dangerous projectiles! The improper use of insertion probes under high pressure (anything above ambient pressure) is very dangerous. Use a safety chain under operating conditions. Please keep clear of the meter when the line is being pressurized. Do not loosen the compression fitting when the safety line is not secured.

The VP*FlowMate* is mounted with a 1/2 inch compression fitting. The probe is sealed with a Teflon ferrule instead of a stainless steel ferrule. Teflon may become slippery. The safety line will keep the sensor secure when it accidentally moves out of the compression fitting. NEVER over-tight the fitting, because it might damage the sensor tube.

1. Insert the compression fitting in the welding tap. Use Teflon tape or liquid sealant.

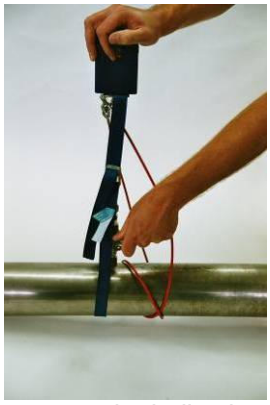
2. Keep the ball valve closed!

3. Insert the VP*FlowMate* probe.

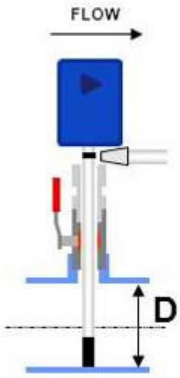


4. Mount the safety line. Hook the safety line up in the ring of the VP*FlowMate*. For extra safety, you can add a luggage strap (like for suitcases).

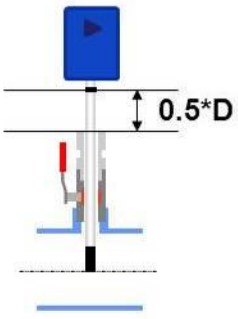
5. Place a mark on the probe, to identify the place where it is safe to close the ball valve when retrieving the VP*FlowMate*.



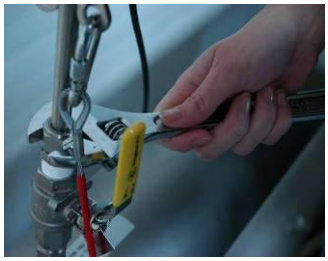
6. Open the ball valve and slowly push the VP*FlowMate* probe completely in.



7. Push the probe in till it hits the bottom of the pipe. Now place another mark on the probe.



8. Retrieve the probe half the pipe diameter. Adjust the safety line (and strap) to keep the VP*FlowMate* in place. Keep in mind to align the VP*FlowMate* with the flow direction.



9. Gently tighten the compression fitting. Do not over tighten to prevent damage to the probe. Pull the probe to check if the compression fitting is tight enough.

10. Now your VP*FlowMate* probe is installed.

Pipe diameter vs. flow range
Insertion mass flow meters can be used in various pipe sizes. This is a great advantage, as you can use one probe for many applications and installation is very easy. VPInstruments recommends the VP*FlowMate* for usage in pipe diameters larger than 2". Flow meters are spot measurement devices; they calculate the flow from the measured mass flow velocity and the pipe area. They only need to know the pipe diameter to calculate the flow for you. How to configure your VP*FlowMate* probe is explained in the next chapters.

For you convenience we have included a table with calculation from mass flow range to m^3_n/hr for standard pipe diameters. You can also use our VPCalculator software that you can download, free of charge, from our website www.vpinstruments.com.

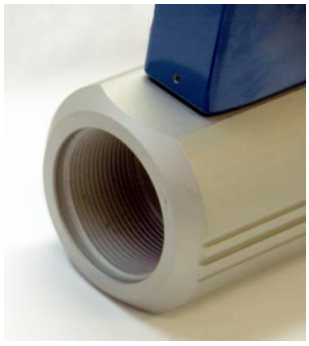
Diameter (mm)	Min flow (m^3_n/hr) rounded down to 5 m^3_n/hr)	Max flow (m^3_n/hr) rounded down to 5 m^3_n/hr)
55	4	1,245
80	5	2,705
100	10	4,235
160	35	10,855
200	55	16,955
250	85	26,500

3.4 Installation of the VPFlowMate in-line

Up- and downstream length
Also the VP*FlowMate* in-line requires a minimum up- and downstream length of at least 20 times the pipe diameter at the inlet and 5 times the pipe diameter at the outlet. As you have read in chapter 3.2, in some applications this distance has to be longer.

Installation of VPF*lowMate* in-line Base.
When you ordered your VPFlowMate in-line only as a base model, it is delivered without up-and downstream piping. You can install it directly between two threaded pipe ends. Please be aware that the connection between the pipe and the VP*FlowMate* Base is very important, any diameter mismatch will result in higher inaccuracy. For example the inner diameter of the pipe may affect the reading. Depending on the pipe wall thickness, the inner diameter can be smaller, which results in a higher measurement value. If you want to be sure of the connection, ask us to supply you with the piping kit.

The connection is BSP inner straight thread; 0.5", 1" or 2" depending on the VP*FlowMate* in-line model.

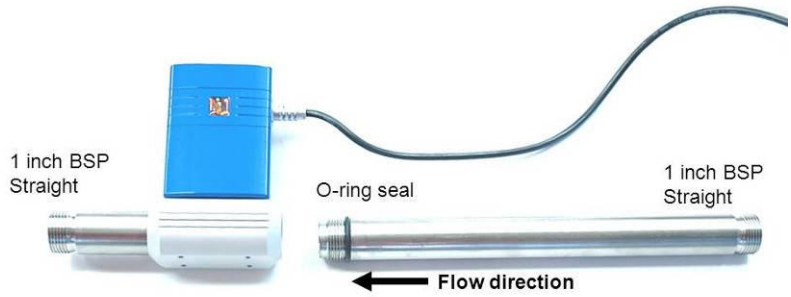


Installation of VPFlowmate in-line with tubing kit

When you ordered the tubing kit or a full start kit, the VP*FlowMate* in-line is delivered with an up and downstream piping kit, to ensure at least 20 times the pipe diameter (for 0,5 inch and 1 inch) upstream length. For economical reason, the 2 inch model is delivered with the pipe length of 15 times the pipe diameter upstream. For optimum results, see the piping table and create additional upstream pipe length when required.

Check the pipework and the O-ring. Apply a little O-ring grease to ease the mounting process. Screw both pipes into the VP*FlowMate.* Gently screw the pipes into the flow meter inlet. Turn it all the way in, until the end of the pipe reaches the bottom of the inlet hole.

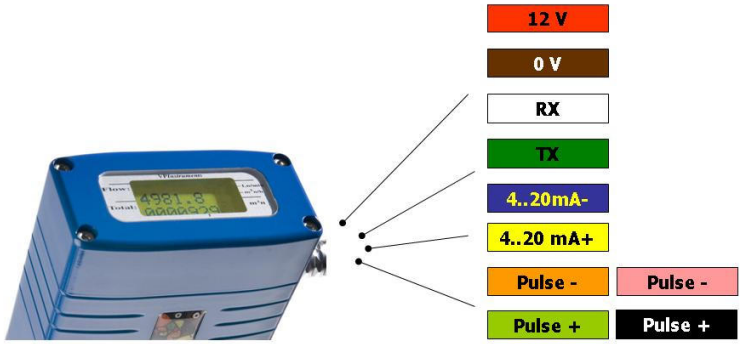
You can install the VP*FlowMate* in-line directly between two threaded pipe ends. The connection is BSP outer straight thread: 0.5", 1" or 2" depending on the VP*FlowMate* in-line model. When necessary you can ask our sales team to supply NPT thread on the tubing kit.



4. Electrical Connection

Familiarize yourself with the different connection possibilities of the VP*FlowMate* and their usage. (See appendix B for electrical information and CE and UL guidelines.)

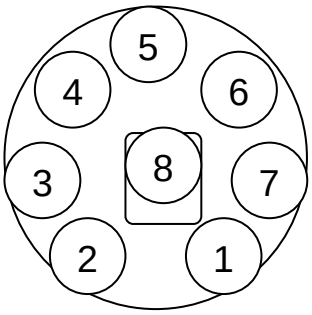
The VP*FlowMate* probe and in-line provide RS232, 4..20mA and pulse output. The cable wiring connections shown here:



Always use a proper power supply. Refer to the specifications to make sure your power supply is +12..24 Volt Class 2.

Wrong connection of the power supply may destroy the RS232 input of your laptop! Never apply +12..24 Volt to any of the pins of the SUB D connector!

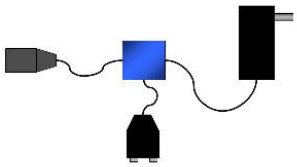
Connector lay out:



1 White	RX
2 Brown	- VDC
3 Green	TX
4 Yellow	+ 4-20 mA
5 Green/black	+ pulse
6 Orange/pink	- pulse
7 Blue	- 4-20 mA
8 Red	+ VDC

4.1 Plug and play (connection possibility to PC)

The plug and play connection is connection via interface box to the power supply and via an RS232 cable to your computer.



VPA.0000.102 Interface box kit

Usage:

- For connection to PC for configuration of your VP*FlowMate.*
    - The VP*FlowMate* probe needs to know the inner pipe diameter, to calculate the flow. The pipe diameter needs to be entered with the VPStudio software. In the next chapter VPStudio is explained. The VP*FlowMate* in-line is already equipped with the inner pipe diameter and can be used directly.
    - For the VPFlowMate probe set the flow meter in m_n/sec or m^3_n/hr
    - Other configuration possibilities: set 4..20mA (for VP*FlowMate* probe only) change reference conditions to match the output of the compressors in your installation, and reset of the totalizer.
- For stand-alone: read out in the display of mass flow and total consumption.
    - For short time measurements this option is very useful. For permanent measurements, we do not advice this option since the connection is not very solid.

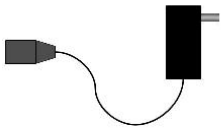
Option real time read out in VPStudio

Via the interface box you can read out the flow real-time in VPStudio. This extra option also enables real-time logging of the data on your computer. Check out the next chapter for this feature.

4.2 Stand alone

Usage: Read out of flow and total consumption in the display.

1. Directly connected to a power supply. All you have to do is plug the power supply in the wall socket.



VPA.0000.100

2. Another option for stand-alone is connection via cable with open wires and connecting the power to the wires. This is a solid permanent connection.

VPA.0000.005

For your convenience we can also supply the cable with interface box with screw terminals inside.

4.3 Using 4..20mA output

Use the cable with open wires, apply power and connect the 4..20mA e.g. to the Central Building System for further usage. The 4..20mA output is also available in the interface box or via the VPFlowTerminal option.

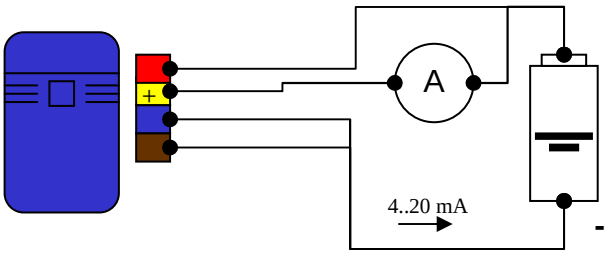
Usage:

- Read out of flow.
- Control of equipment like valves.
- Read out at Central Building Systems, read out in existing equipment.
- Read out via the monitoring software of VPInstruments: VPVision or AirVision.

The 4..20mA output is passive, optical linear. See the connection scheme:

VPFlowMate model	4 mA	20mA	Unit		
VPF.R060.M050.D1	0	60	m^3_n/hr	500	l_n/min
VPF.R200.M100.D1	0	200	m^3_n/hr	2000	l_n/min
VPF.R01K.M200.D1	0	1000	m^3_n/hr		
VPP.R150.P400	0	150	m_n/sec		

Current output (4..20 mA)



The 4..20mA output default is from 0..100% of the flow range. The default settings for the different VPFlowMate models are:

For the VPFlowMate probe you can change the 4..20mA output. You can change it to the unit m^3_n/hr and you can set the maximum output.

4..20mA setting
The 4..20mA output default is from 0..100% of the flow range. For the VP*FlowMate* probe only, you can lower the maximum flow with VPStudio to better fit your application for better accuracy.

In appendix C we show some extra tricks that you can do with the 4..20mA output.

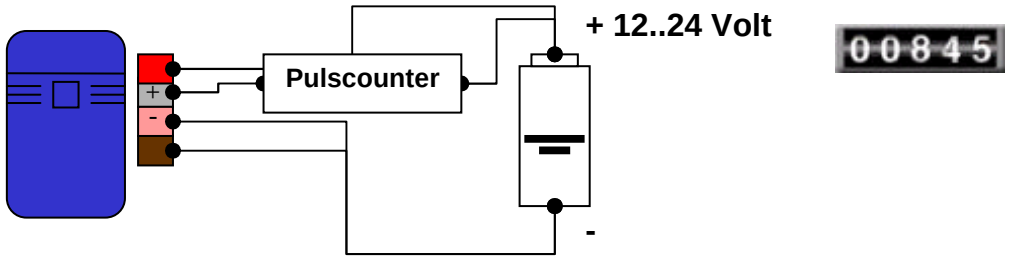
4.4 Using pulse output

The VP*FlowMate* features a low-frequency pulse output, which is compatible with NAMUR (potential free) relay outputs. For the in-line models, the pulse size is fixed. For the insertion probes, the pulse size varies with the installation diameter, see appendix D. In VPStudio, the pulse output size can be read out.

Use the cable with open wires, apply power and connect the pulse e.g. to the Central Building System for further usage. The pulse output is also available in the interface box or via the VPFlowTerminal option.

Usage: read out of total air consumption.

Pulse output (opto isolated relay/ NAMUR compatible)



4.5 Connection with VPFlowTerminal

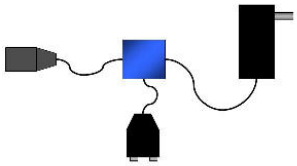
When you cannot read out the display of your VP*FlowMate*, e.g. because your flow meter is too high, you can use the VPFlowTerminal; a remote display. For connection and further usage, we refer you to the sales team of VPInstruments and the user manual of the VPFlowTerminal.

5. VPStudio software

Learn in this chapter how to configure your VP*FlowMate* and how you can view real time data in VPStudio.

IMPORTANT: Use your mouse when using VPStudio. Do not use the arrows of your keyboard for this!

Connection
You need to have the following to connect your VP*FlowMate* to the VPStudio software:



VPA.0000.102 Interface box kit

Or make your own RS232 connection, see appendix E.

Basic configuration
The VP*FlowMate* probe is a spot measurement device and needs to know the inner pipe diameter to give read out of flow in m^3_n/hr. Therefore you have to configure the VP*FlowMate* probe with this diameter. The VP*FlowMate* in-line is already programmed with this diameter and can be used directly.

Advanced configuration
There are also advanced configuration possibilities for your VP*FlowMate*: set 4..20mA (VP*FlowMate* probe only), change reference conditions to match the reference conditions of output of the compressors in your installation, and reset of the totalizer.

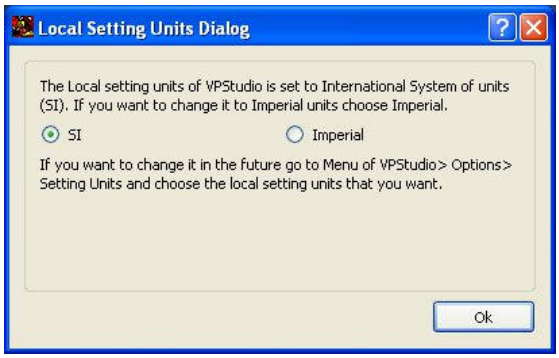
Real time read out
You can view your real-time data in graphs in VPStudio. By exporting the data to a csv.file, you can use the data for further analysis.

Menu
In the Menu of VPStudio you can find a direct link to CSV Studio: You can go directly to our program CSV Studio. When you have exported data and you still want to change units, for instance change the flow from m_n/sec to m^3_n/hr, you can do this by using CSV Studio.

5.1 Installation of the VPStudio software

Install VP*Studio* software
Insert the CD ROM delivered with your VP*FlowMate*. Install VP*Studio* by clicking the vpstudio.msi file and follow the installation steps. All necessary drivers for later on can be found in the program folder of VP*Studio* on your computer, subfolder 'Drivers'.

Install the Serial-USB driver
Connect the RS232 converter to the interface split box. After inserting the converter in the PC, the computer will recognize the USB converter and it will install the driver. Note that every time you put the RS232 converter in a different port, the computer needs to install the driver again.

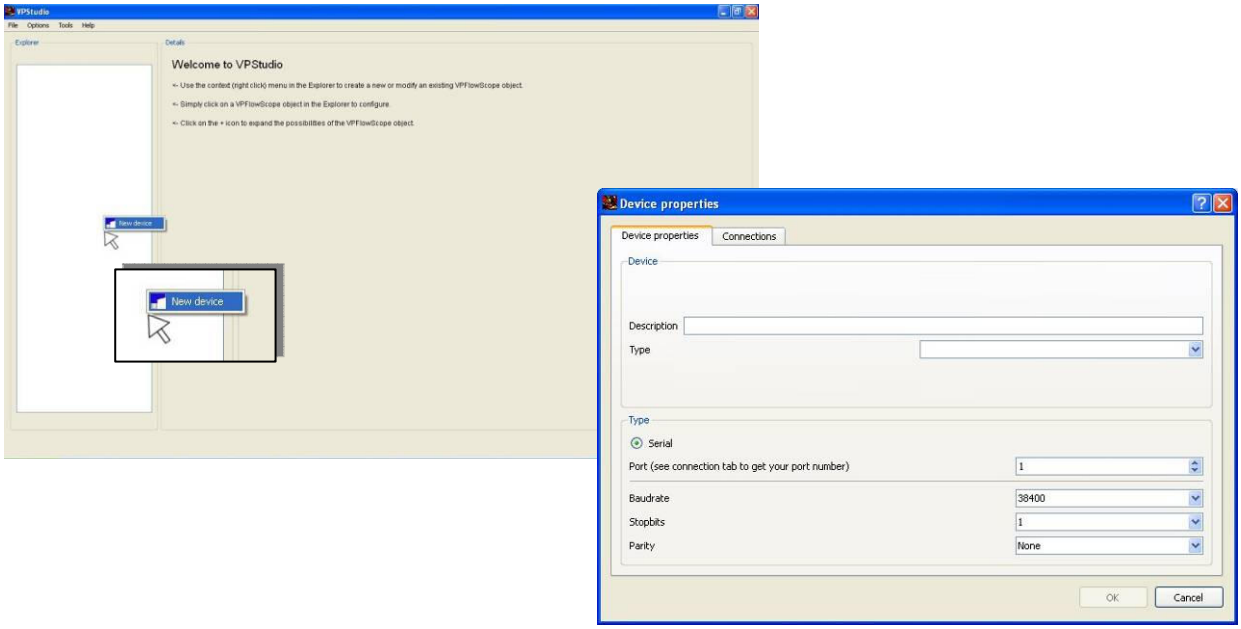

Local Setting Units Dialog
The Local setting units of VPStudio is set to International System of units (SI). If you want to change it to Imperial units choose Imperial.
SI
Imperial
If you want to change it in the future go to Menu of VPStudio> Options> Setting Units and choose the local setting units that you want.
Ok

Set units
Open VP*Studio*. Always plug in the RS232 converter first and then start up VP*Studio*. When you open VPStudio for the first time, a pop up appears. SI Units and Imperial Units are both implemented in VPStudio. The VP*FlowMate* works only with SI Units.

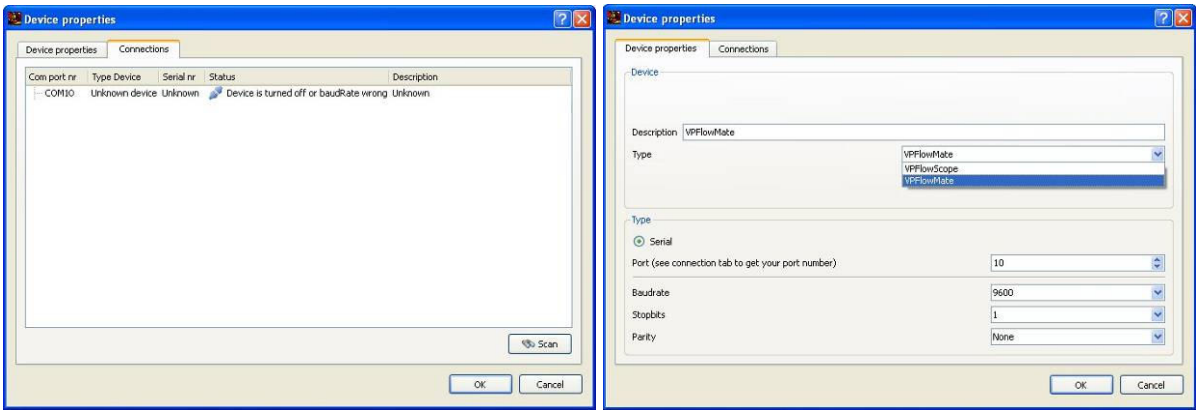
5.2 Adding your VPFlowMate

To read out the VP*FlowMate* and to configure the device, you first have to create your VP*FlowMate* in the software. Click right mouse button in the explorer field and click ‘New device’.

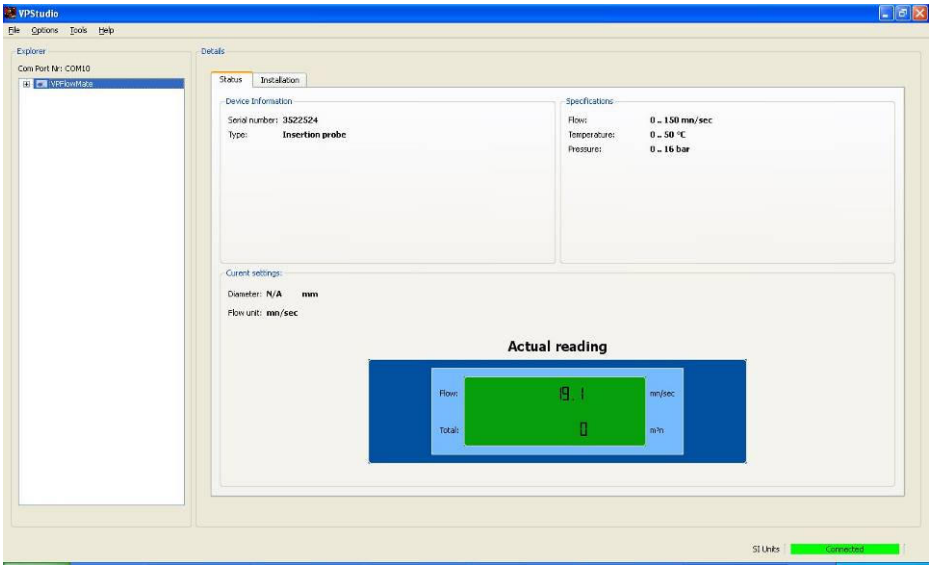
The ‘Device properties’ window appears.



Write in the ‘Description’ field a name of your choosing (VPFlowMate here). Select ´VPFlowMate´ in the drop down menu of ‘Type’. You have to define the right port number to which your VP*FlowMate* is connected to the PC. Go to the ‘Connections’ tab to see which port number correspond with the VP*FlowMate*. Here you can see there is a device in COM port 10. Go back to the ‘Device properties’ tab and type in 10 at port. Keep the default Baudrate and other communication settings default.



Click OK to confirm. The VP*FlowMate* is added in the explorer field.



5.3 Status and Specifications

In the Status tab you see the specifications of your VP*FlowMate*. You can view for instance the serial number and the specifications like flow range.

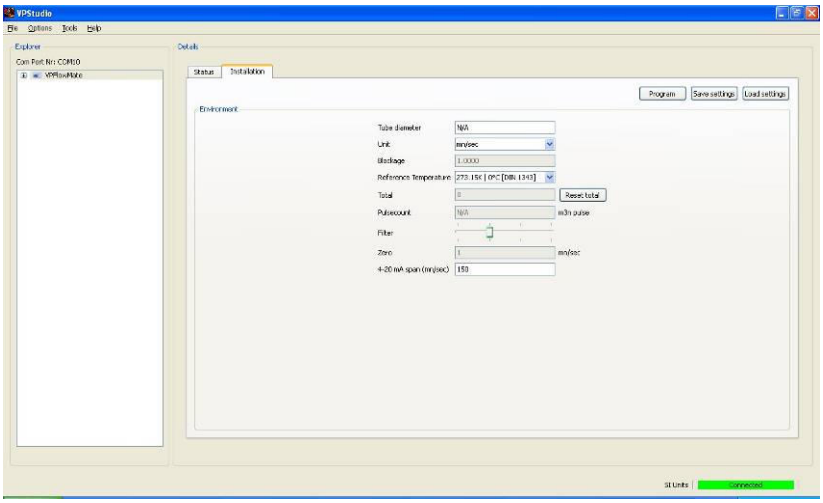
In current settings you can see the pipe diameter and the flow unit that are currently configured, including a view of the display with real-time data.

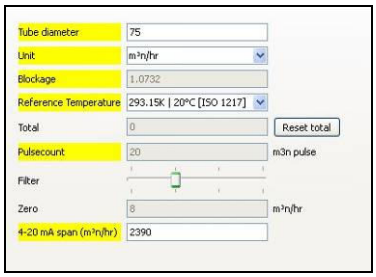
In the right corner below you can see the connection status of your VP*FlowMate*. This should be green and set to ‘connected’. When it is red and states ‘disconnected’, please check if you have wired and connected the VP*FlowMate* correctly. You can also see in the right corner below that you are using SI Units.

Sometimes the connection needs refreshing. When you do not get a connection, try to start VPStudio again, or re-click on the icon in the tree in the Explorer field.

5.4 Configurating your VPFlowMate

Go to the Installation tab to configure your VP*FlowMate*.





Default setting is measuring the velocity in m_n/sec; a diameter is not necessary in this case. For m^3_n/hr read out, choose the unit m^3_n/hr. You see fields light up yellow that are changing. Now you can enter your pipe diameter. Choose the reference conditions of your application, to have immediately the right flow output to match your application.

You can also reset the totalizer, by clicking ´Reset total´. For the VP*FlowMate* probe, you can lower the 20mA output to better fit the flow range of your application.

Press 'Program' to store your settings in the VP*FlowMate*.

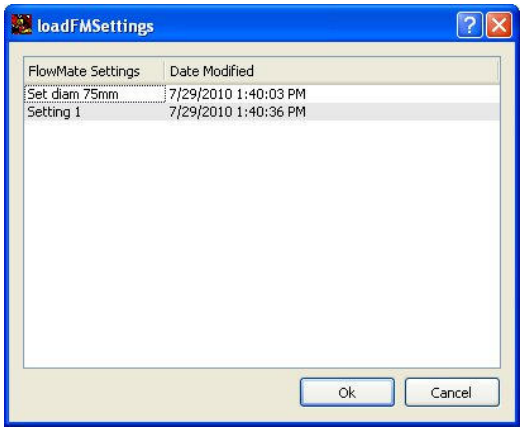
In-line flow meters
For the VPFlowMate in-line the unit and the pipe diameter is fixed, so you cannot change this. Also the 4..20mA output is fixed and cannot be changed.

Save settings
Settings are often the same for different applications or you might visit a site more than once. Therefore we have implemented that you can save your settings, so you can use the same settings for another VP*FlowMate* as well. This will save you time in configuration.

Enter your configurations, then press 'Save Settings'. Enter a name and click OK.

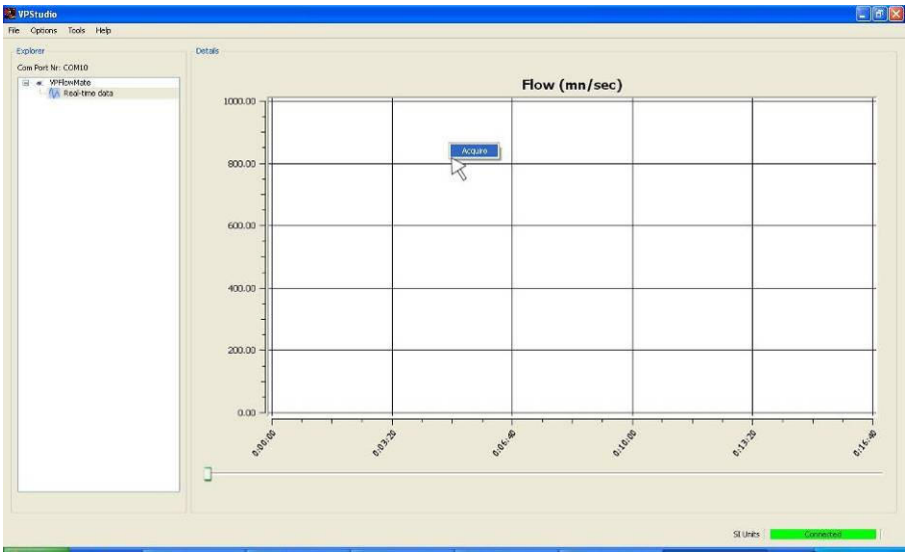
To load your settings, press 'Load Settings', choose your saved setting and your settings appear in the ´installation´ tab.

Still press 'Program' to configure the VP*FlowMate* with these settings.



5.5 Real-time data

Click the + in front of your VP*FlowMate* in the 'Explorer field' to open the tree. Click on 'Real-time data' to go to the graph. Go with your mouse in the graph, click right mouse button and 'Acquire' to read in the real-time data of your flow meter.



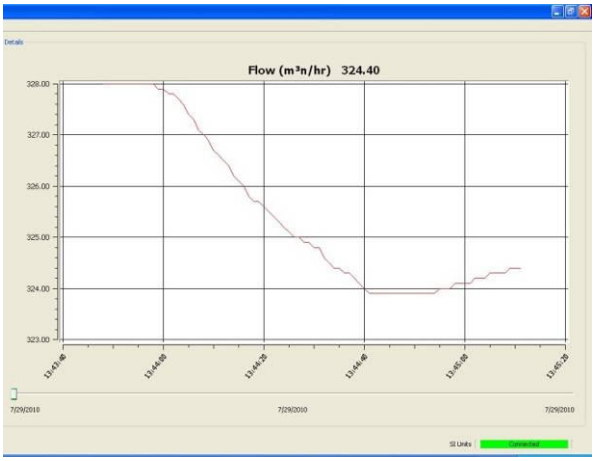
The sample rate is fixed and is 1 sample/sec (every second a measurement is taken). The graph in VP*Studio* is refreshed every 5 seconds.

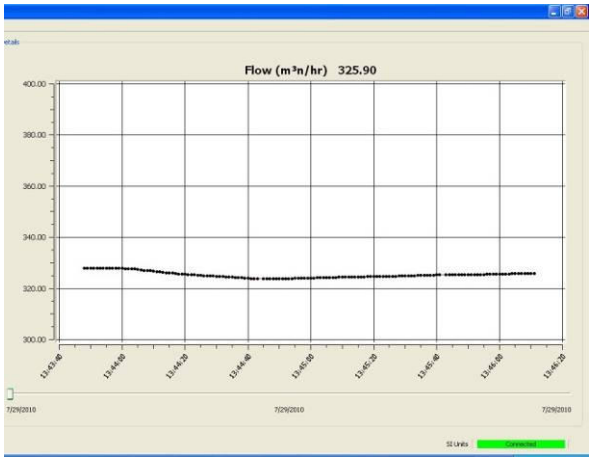
Change graph

Click right mouse button on the graphs to change the layout of graphs.

- You can set flow to m_n/sec or m^3_n/hr
- Change the layout of the axis to automatic or a fixed scale
- Display markers

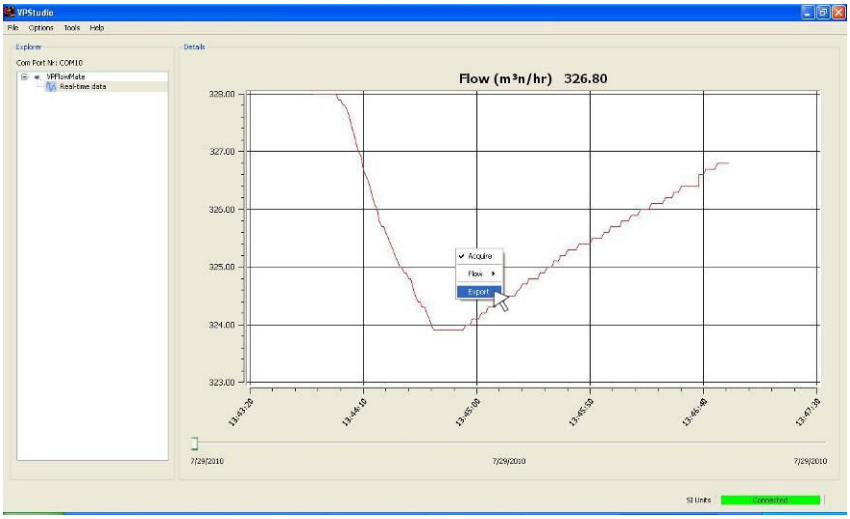
See some examples

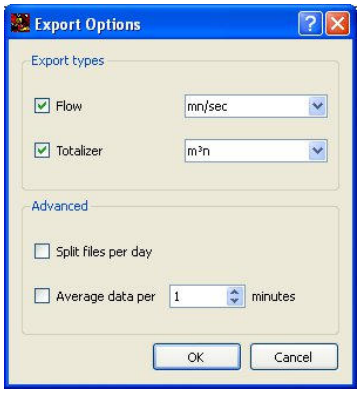




Export to csv.file

As long as you have the ´Real-time data´ selecting, the graph is reading in your flow data. Any time you can export the data so far by clicking right mouse button and go to 'Export'.





Choose a name and a place for your export file, click OK. The 'Export Options' dialog appears. Here you can choose which data to export and in what matter. Click OK and you can use the csv.file for further data processing.

In appendix F you can find additional information on how to make graphs from a csv.file in Office Excel.

6. Service

The VP*FlowMate* needs regular maintenance to ensure that the product is functioning properly. Especially when the product is used for mobile air audits, we recommend inspecting the instrument before and after every audit to ensure that the product has not been damaged.

For precision measurement equipment such as the VP*FlowMate*, a proper maintenance program is key to reliable measurement results and a long product lifetime.

6.1 Cleaning the sensor

The sensor can be gently cleaned using cleaning alcohol or an ultrasonic cleaning bath. You can use aluminium friendly electronics cleaning fluid. Damaged sensors need to be returned for re-calibration or exchange.

6.2 Software and firmware updates

News on software and firmware updates can be found on www.vpinstruments.com, or are provided by your local re-seller.

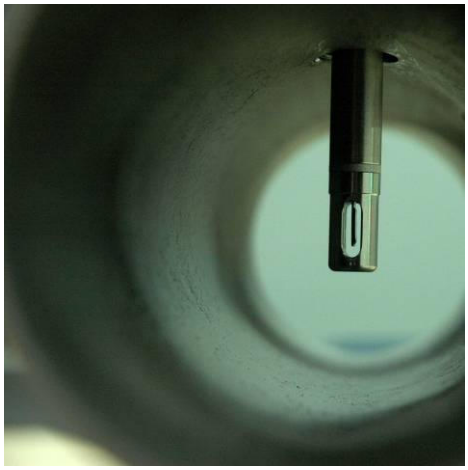
6.3 Recalibration

To keep your VP*FlowMate* in best shape, it needs recalibration. Calibrations are executed at the calibration facility of VPInstruments. For optimum use of your equipment, we advise annual recalibration.

6.4 Service contract

VPInstruments offers several Service Subscriptions. Enrolling in the Service Subscription Program helps you get the most out of your measurement equipment. We keep your equipment in excellent shape, as we offer an annual re-calibration on our state of the art calibration equipment. With the latest software releases and expert technical support, you will save time and money. We offer the following programs:

- Standard Service Subscription; annual re-calibration of your flow meter and up to 5 years warranty extension.
- Full Service Subscription; annual exchange of your flow meter. No service time! Have a fully calibrated flow meter 24/7, 365 days a week!



Improved software performance, innovative new product features, and technical support helps keep you focused on what matters most for your company.

Benefits
- Annual calibrated and cleaned instruments
- Warranty extension
- Software- and firmware updates
- Live support and e-mail support by our skilled technicians

Consult your sales agent for information about our service program.

6.5 First Aid Help

Is your VP*FlowMate* not working correctly, please check the table below to perform the first diagnosis and to see if you can fix the problem. Contact us when you have any other problem or if you continue with having problems.

Table 6.1. Possible Solutions to common Basic Failures.

Symptom	Possible causes	Action
No output signals	No power supply Bad cable Wrong connections General failure Wrong installation	Check power Check cable Check wiring diagram Consult factory The flow is too low to be detected or the flow meter is mounted in a wrong way
Deviating output signal	Out of calibration Extreme pollution Wrong installation	Consult factory Consult factory Check alignment of probe Check up- and downstream lengths Check for obstructions in flow pipe
Display shows 0&@*&-	Possible interference RX line open	Connect RX line (white) to ground
Connection problems with VPStudio and Display shows .00000000 E+00 :+1	The VP*FlowMate* is stuck in a routine and needs to reboot	Re-connect the cable of the VP*FlowMate*

7. Specifications

Please always check the label of your product for the specifications

	VPFlowMate probe	**VPFlowMate in-line**
Measurement	- Mass flow - Total consumption	
Flow sensor		
Measuring principle:	Thermal mass flow	
Flow range:	0.5…150 mn/sec	See range table below
Accuracy:	0.5% of span. Please note that for insertion probes, the field accuracy depends on installation conditions.	0.5% of full scale when with tubing kit and ISO calibration report. Other: 5% of full scale
Reference conditions:	0 degrees Celsius, 1013.25 mbar	
Gases:	Compressed air, Nitrogen and inert, non condensing gases	
Gas temperature range:	0....+50 deg C	
Pressure range:	0..16 bar gage	
Humidity range:	Up to 95% Relative Humidity, non condensing	
Display:	Optional	Standard
Technology:	Liquid Crystal (LCD)	
Back light:	Yellow	
Read out of:	- Mass flow in m^3_n/hr or m_n/sec Total consumption in m^3_n	Mass flow: / Model / Unit VPF.R060.M050 / ln/min VPF.R200.M100 / ln/min VPF.R01K.M200 / m3n/hr Total consumption in m^3_n
Mechanical:		
Probe lengths:	**400 mm** (300, 600 mm)	
Process connection:	Connected with 0.5" compression fitting	See range table
Protection grade:	IP65, avoid direct sunlight and rain	
Housing material:	Aluminium, painted	
Wetted materials:	Epoxy, glass, stainless steel 316	
Corrosion resistance:	Highly corrosive or acid environments should be avoided	

Electrical		
Outputs:	RS232, 4..20mA (isolated), pulse (isolated)	
Power supply:	12...24 VDC +/- 10 % Class 2 (UL) Power consumption < 100mA. Peak power at start up 500mA	
Connection type:	Multi pole connector	M12 connector
Approvals/conformity:		
CE:	EN 61326-1, EN 50082-1	
UL/ CUL:	14 AZ, Industrial Control Equipment	

Range table VPFlowMate in-line and Lite						
Model	Qmin (m^3_n/hr)	Qmax (m^3_n/hr)	Qmin (l_n/min)	Qmax (l_n/min)	DN (mm) indicative	Process connection (NPT adapters available)
VPF.R060.M050.D1	0.32	60	5.3	1000	15	0.5” BSP
VPF.R200.M100.D1	0.88	200	14.7	3333	25	1” BSP
VPF.R01K.M200.D1	3.53	1000	58.9	16666	50	2” BSP

Appendix A: Mass flow and volume flow

Definition of mass flow
Mass flow rate is the mass of substance which passes through a given surface per unit time. Its unit is mass divided by time. This means: kilogram per second in SI units, and slug per second or pound per second in US customary units.

Mass flow rate can be calculated from the density of the substance, the cross sectional area through which the substance is flowing, and its velocity relative to the area of interest:

$\dot{m} = \rho * v * A$ where: $\dot{m}$ = mass flow rate
ρ = density
v = velocity
A = flow area

Definition of a Normal cubic meter (m^3_n)
A normal cubic meter is used to relate mass flow to a volumetric unit. A normal cubic meter is the volume of 1 m^3 of air at temperature of 0℃ and pressure of 1013, 25 mbar abs. The mass of 1 m^3_n of air is 1293 gram.

The normal cubic meter is officially indicated with a subscript “n” behind the volumetric unit. The indication Nm is not correct.

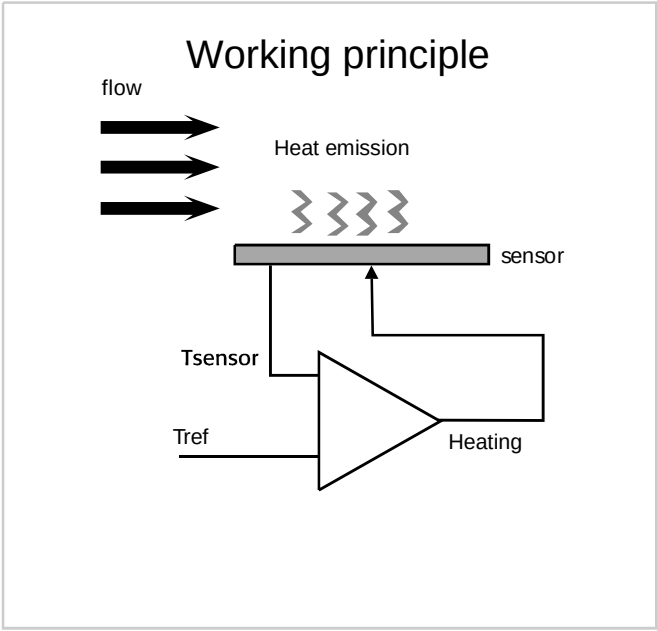
Other common normal conditions:
- 20˚C reference (FAD): See ISO 1217
- 15˚ reference: See DIN 1533

VP*FlowMate* and mass flow
The VP*FlowMate* insertion probe is calibrated in **normal meters per second (m_n/sec)**. A normal meter per second is a meter per second under the same reference conditions as a normal cubic meter. This enables you to use the VP*FlowMate* in various pipe diameters. The VP*FlowMate* only needs to know the inner tube diameter to calculate the mass flow rate.

Working principle of the VP*FlowMate*
The VP*FlowMate's* thermal sensor measures mass flow. The sensor response signal is directly related to the mass flow rate and can be described by the following formula:

Vout = k *λ* ρ * v * (Ts-Tg)

Vout = output voltage
k = sensor (geometrical) constant
λ = thermal conductivity of the gas
ρ = density of the gas
v = actual velocity in m / sec
Ts = sensor temperature
Tg = gas temperature



Appendix B: Electrical installation

The VP*FlowMate* complies with the CE requirements as stated in the CE declaration. CE compliance can only be achieved when grounding and shielding directions are followed and proper cables and connector assemblies are used.

Electrical connection guidelines- UL 508 Listing for USA & Canada

The VP*FlowMate* is intended to be used with a Class 2 power source or Class 2 transformer in accordance with UL1310 or UL1585. As an alternative a LVLC (Low Voltage Limited Current) power source, with the following properties can be used:

- The device shall be used with a suitable isolating source such that the maximum open circuit voltage potential available to the product is not more than 24 V DC and the current is limited to a value not exceeding 8 amperes measured after 1 minute of operation;

- A fuse in accordance with the UL248 series and rated max 4A, shall be installed in the 24V DC power supply to the device in order to limit the available current.

Electrical connection guidelines: general remarks

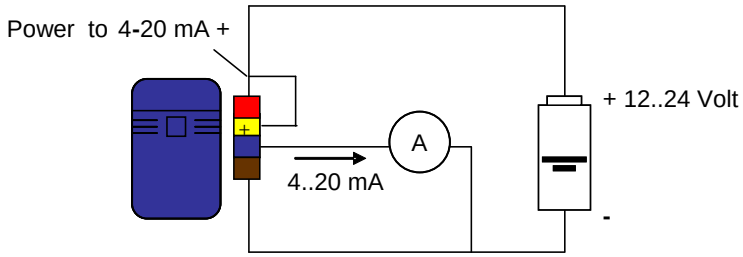
Make sure that the following conditions are met:

- For portable, non-critical applications, a switched mode 12 V DC, 1A power adapter may be used. Switched mode power supplies that are of poor quality, might affect the accuracy.

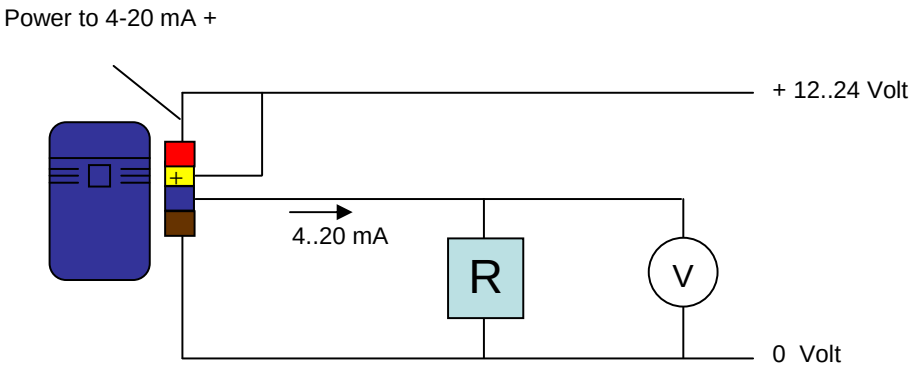
Appendix C. Extra tips for electrical connection

This appendix describes extra option for the output of the VP*FlowMate*.

Creating from the passive current output an active current output.



Creating voltage output from 4-20 mA output using a register



R	V
100 ohm	0.4..2 Volt
500 ohm	2..10 Volt

Appendix D: Pulse output

For VP*FlowMate* in-line: pulse is fixed

Model	Pulse size	
VPF-R060-M050	10	L_n
VPF-R200-M100	50	L_n
VPF-R01K-M200	1	m^3_n

For VP*FlowMate* probe: dependent on pipe size:

Pipe diameter	Pulse size in m^3_n
In mm	R150
	1
	1
	1
	2
110	2
150	5
160	5
200	5
300	20
400	20
500	50

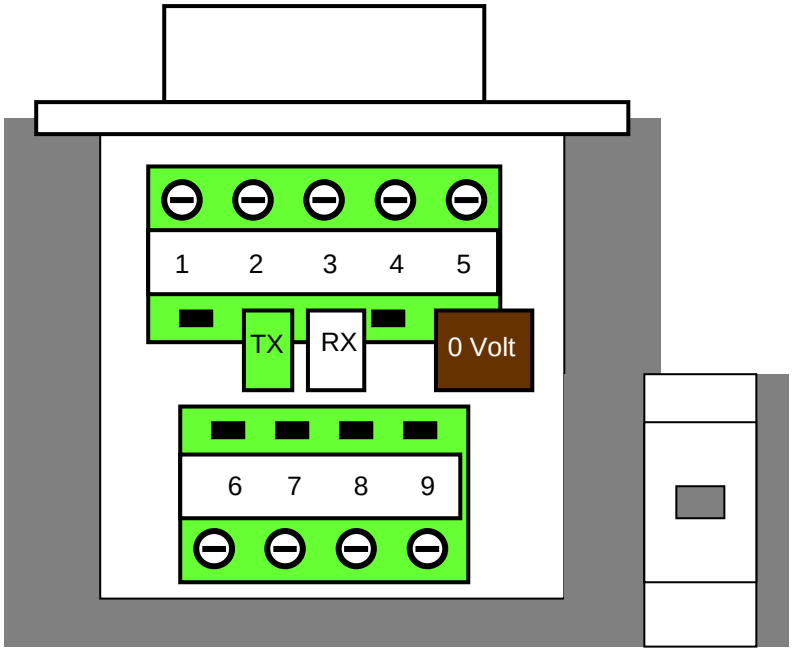
Appendix E: Do it yourself RS232 wiring

In this example, a SUBCON® connector of Phoenix Contact is used. The pin number is placed on the terminal block, If you use an ordinary SUB-D connector, you will find the pin numbers imprinted in the connector isolation material.

(ordinary female sub D)

Phoenix Contact SUBCON®
SUB-D connector

Easy to use SUBCON
(www.phoenixcontact.com)



To Power supply

0 Volt (brown)

+12..24 Volt (red)

To VP*FlowMate*

0 Volt (brown)

+12..24 Volt (red)

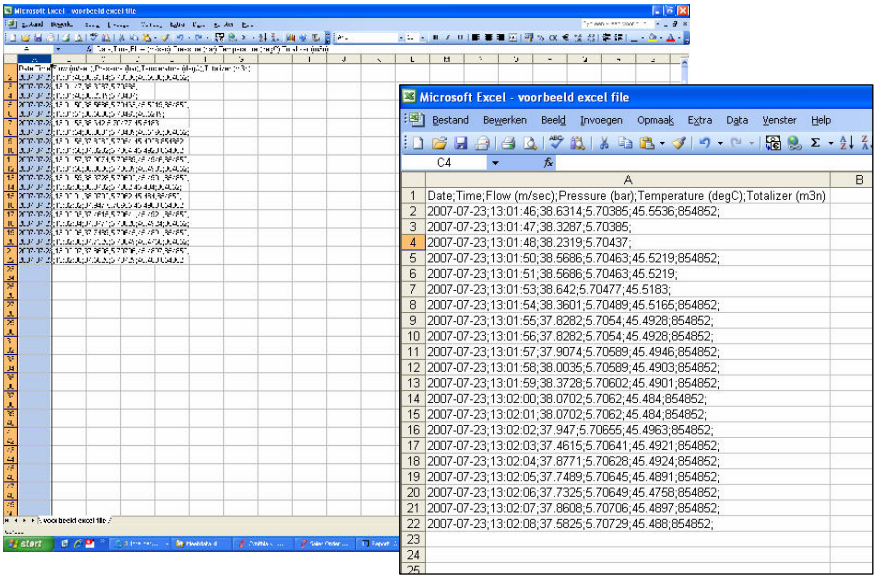
RX (White)

TX (green)

Cable shielding (metal)

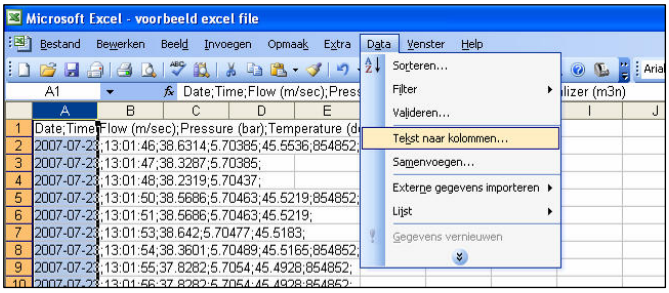
Appendix F: Basic graphs in Excel

Open your csv.file with Excel.



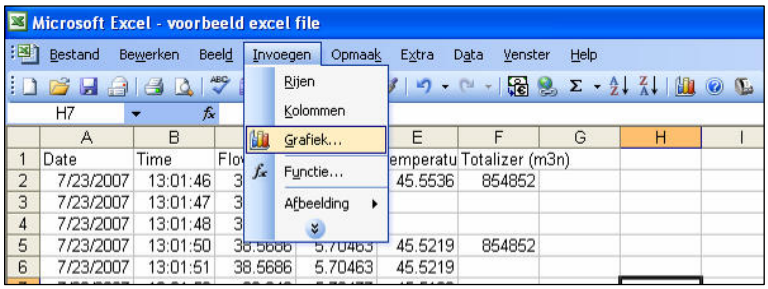
To convert the data to different columns, select the first column, as seen above and select in the menu bar ‘Data’ ‘Text to columns’.

A wizard appears, select ‘Separated’ and click ‘Next’. Subsequently select ‘Semicolon’ and click ‘Finish’ (see picture below). Now the data is divided over columns.

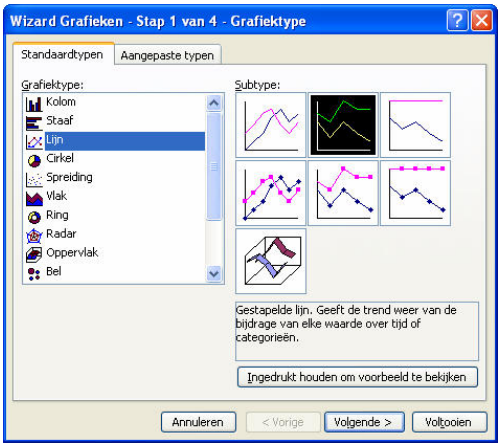


Wizard Tekst naar kolommen - Stap 2 van 3
In dit venster kunt u opgeven welke scheidingstekens voorkomen in uw tekst. In het voorbeeld kunt u zien welke invloed uw instellingen hebben op de tekst.
Scheidingstekens
Tab
Puntkomma
Komma
Spatie
Overige:
Dubbele scheidingstekens als één beschouwen
Tekstindicator:
Voorbeeld van gegevens
Date Time Flow (m/sec) Pressure (bar) Temperature (degC)
2007-07-23 13:01:46 38.6314 5.70385 45.5536
2007-07-23 13:01:47 38.3287 5.70385
2007-07-23 13:01:48 38.2319 5.70437
2007-07-23 13:01:50 38.5686 5.70463 45.5219
Annuleren
< Vorige
Volgende >
Voltooien

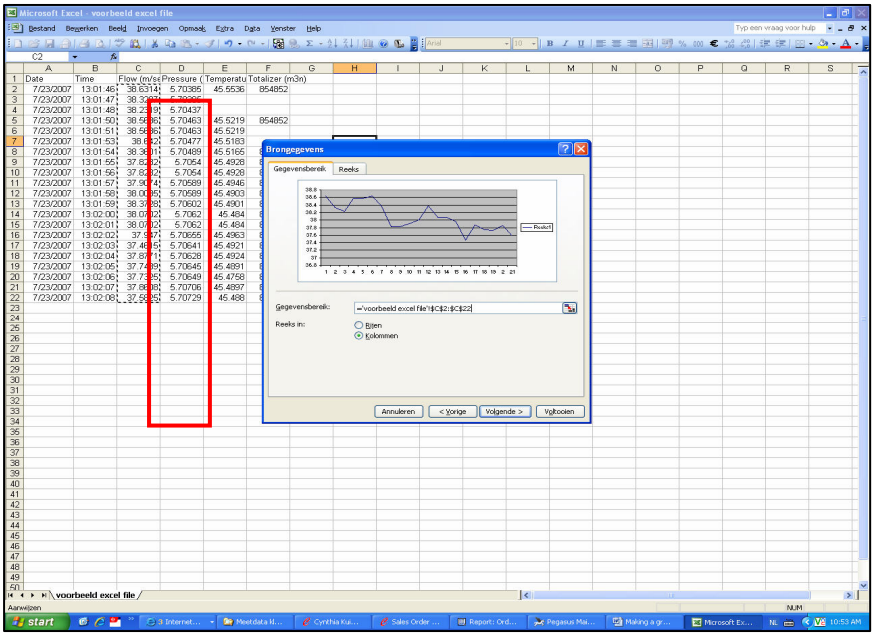
Select in the menu bar ‘Add’ ‘Graphic’.



The wizard for making a graph appears. First select the type of graphic you'd like. I am choosing a smooth line graphic:



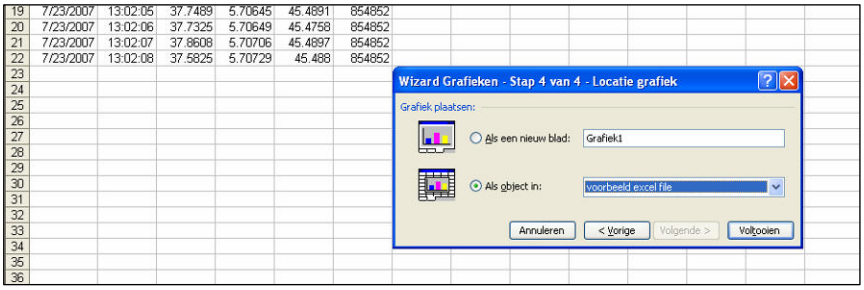
Click "next". Now select the data you want to see in the graph:

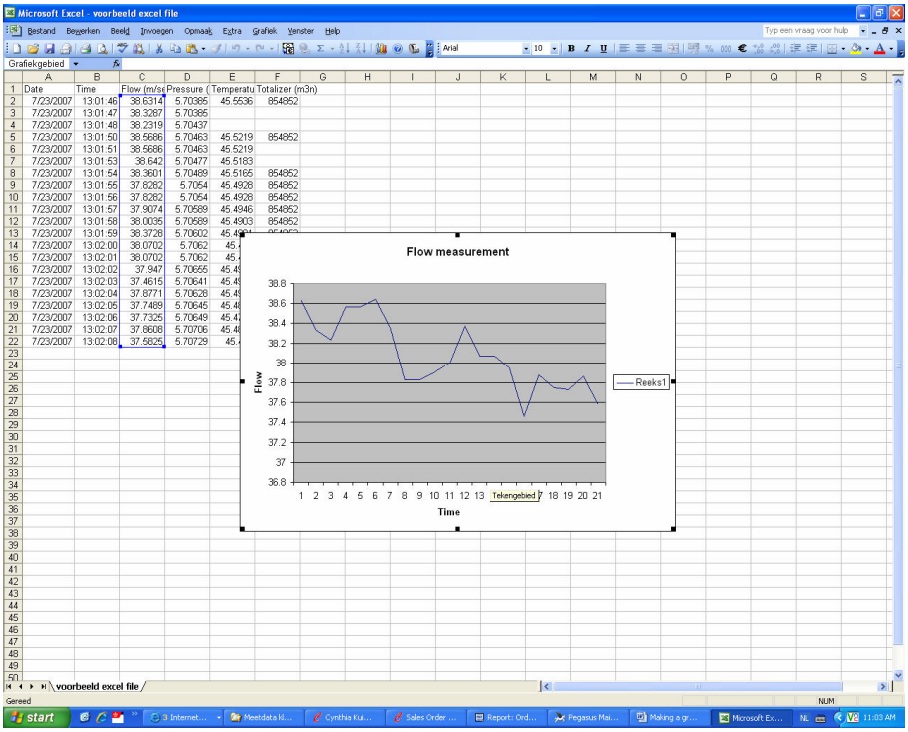


Go to the second tab to give the graph a name or to add more graphs in the same graphic. Click 'Next'. Move through the different tabs to e.g. name the total graphic and the axes. You can also change the axes, legend, etc. They can be useful to make the graphic clearer and better readable. Click "next"

Choose where you want to place your graphic, in the current tab or in a new tab and click "complete".

The graph appears.





You can adjust the lay out of the graph, like colour or size, by clicking on the different features. To change the range of the axes, place your mouse on an axis and click right mouse button.

You can use the graphs in your reports.

Notes

www.vpinstruments.com